Solutions

CHEM 155A – Practice Exam I

1. **Which of the following is a major difference between eukaryotic and prokaryotic organisms?**
   A) Only eukaryotes have DNA
   B) Only prokaryotes have mitochondria
   C) Prokaryotes and eukaryotes are the same
   D) Prokaryotes have a nucleus, Eukaryotes do not
   E) Eukaryotes have organelles, prokaryotes do not

2. **Which of the following is true regarding hydrophobic interactions?**
   A) They involve dipole-dipole interactions.
   B) They are the result of enthalpic effects
   C) They are the result of entropic effects
   D) They only involve polar molecules
   E) They are not important in protein structure

3. **Which of the following is true regarding hydrogen bonds?**
   A) They form between polar molecules
   B) They are covalent bonds between hydrogen and other atoms
   C) They are the result of entropic effects
   D) They form between non-polar molecules
   E) They are stronger than covalent bonds

4. **Which of the following is true regarding water?**
   A) The solid form of water is denser than the liquid form
   B) Each water molecule can form up to 4 hydrogen bonds
   C) Water is a poor solvent for polar and ionic molecules
   D) Water has very low boiling point compared to similar sized molecules

5. **What is the pH of a solution of 0.02 *M* CH_3COOH?**
   A) 1.5
   B) -1.5
   C) 12.5
   D) 0.02
   E) More information is required to calculate the pH

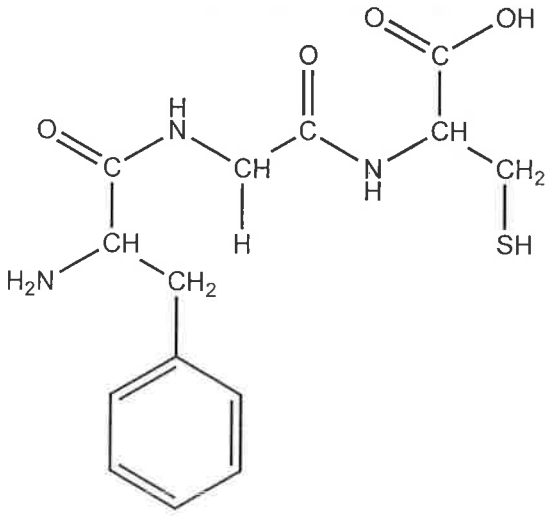
6. **What is of the following acids would be the strongest?**
   A) pKa = 8.3
   B) Ka = 1.4×10^{-5}
   C) pKa = 2.3
   D) Ka = 7.7×10^{-8}
   E) More information is required to answer this question

7. **What is the pH of a buffer composed of 0.3 M $H_2PO_4^-$ and 0.28 *M* HPO_4^{2-}? (pKa = 7.2)**
   A) 7.17
   B) 7.23
   C) 7.20
   D) 10000000

8. **Which of the following amino acids is capable of forming disulfide bonds?**
   A) Pro
   B) Asp
   C) Met
   D) Cys
   E) More than one of these

9. **What is the net charge of Histidine at pH 4.0?**
   A) -2
   B) -1
   C) 0
   D) +1
   E) +2

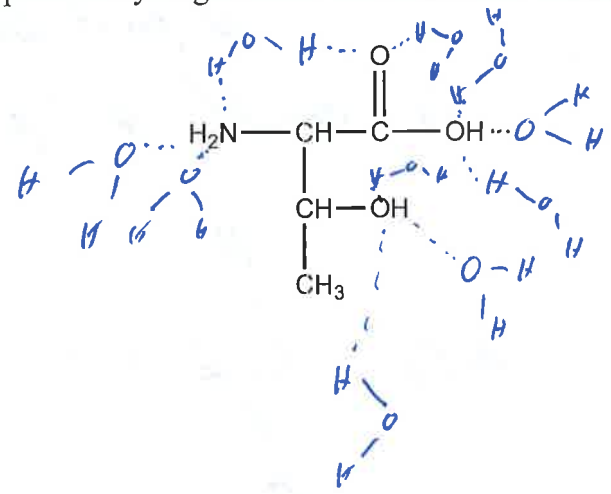
10. **How many peptide bonds are present in the following molecule**



   A) 1
   B) 2
   C) 3
   D) 4
   E) 10000000000000000000000000000000000000000000000000

Part II – Written Answer Questions

1. Draw all the possible hydrogen bonds that could form between the amino acid Thr and water



2. How many mols of HCL would you need to add to a 1 L solution of 50 mM sodium acetate to make a buffer with a pH of 4.5 (pKa of acetic acid is 4.76)?

$pH = pKa + \log \frac{A^-}{HA}$

$4.5 = 4.76 + \log \frac{A^-}{HA}$

$10^{-0.26} = \frac{A^-}{HA}$

$0.55 = \frac{A^-}{HA}$

$0.55\,HA = A^-$

$50 \times 10^{-3}\ mol = A^- + HA$

$= HA + 0.55\,HA$

$= 1.55\,HA$

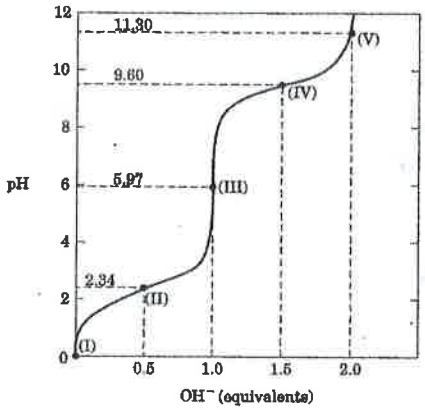
$HA = \frac{50 \times 10^{-3}\ mol}{1.55}$

$= 0.032\ mol$

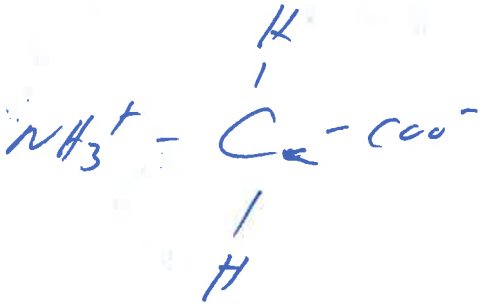
1 mol of HCl converts 1 mol of acetate into acetic acid

so, 0.032 mol of HCl

3. Draw the structure of glycine as it appears at position III on the following titration curve



@ point III net charge is exactly ∅ (pI)



4. What would the net charge of the following peptide be at pH 1.0, 7.0 and 13.5?

Gly-Arg-Asp-Leu

pH 1.0 - NH_3^+-Gly-Arg-Asp-Leu-COOH

= +2

pH 7.0 NH_3^+ COO^-

NH_3^+-Gly-Arg-Asp-Leu-COO^-

= ∅

pH 13.5 NH_2 COO^-

NH_2-Gly-Arg-Asp-Leu-COO^-

= -2